# Soil microbial diversity and related soil functioning in urban parks

S. Bourgerie, Mikael Motelica-Heino, I. Limam, Jean-Louis Yengue, D. Morabito

# Soil microbial diversity and related soil functioning in urban parks

S. Bourgerie [1] , M. Motelica-Heino [2], I. Limam [2], E. Yengué [3], D. Morabito [1]

[1] LBLGC, Université d'Orléans, France

[2] Institut des Sciences de la Terre d'Orléans (ISTO), UMR 7327 CNRS-Université d'Orléans, France

[3] CITERES, UMR 7324 CNRS-Université de Tours, France

## Introduction

The main thrust of this work was to improve the knowledge concerning soil biodiversity and related ecosystem services in soils from urban parks in several cities of the Région Centre, France. In this work, the pedological, geochemical and microbiological characteristics of surface soils were investigated in order to make an inventory of soil fertility in several urban parks of the major cities of the Région Centre, France. The effects of agricultural practices on biomass, community structure and activity of micro-organisms were investigated in these soils in parallel with the determination of various pedo-physical and chemical parameters.

## Material and methods

The microbial biomass and community level physiological profiles were determined by using the MicroRespTM system in topsoils. Surface soil samples (0-20 cm) were also evaluated for physico-chemical characteristics such as the organic carbon and nitrogen concentrations, conductivity and pH together with their structure and texture and other soil physical parameters.

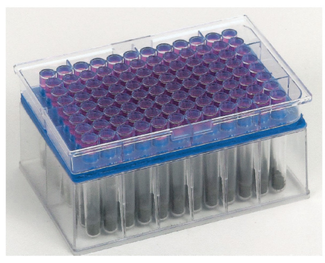

**Pedological study**

Sampling with a edleman auger
2 mm mesh sieving
LaMotte textural soil kit (code 1067)

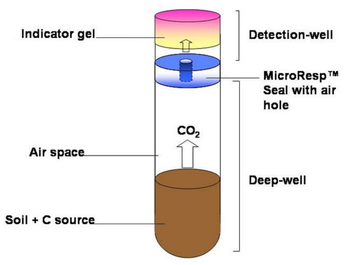
**Physico-chemical study**

pH: distilled water extracts (1:2.5 w/v) (NF ISO 10390)
Total organic carbon: Rock-Eval 6 (Vinci technologies)
Total nitrogen: Flash pyroliser
Exchangeable cations: LaMotte universal extraction solution (S/L 1/10) and ionic chromatography (Dionex ICS-2000, Sunnyvale, CA =)

**Microbial study**



Assembled MicroResp™ system

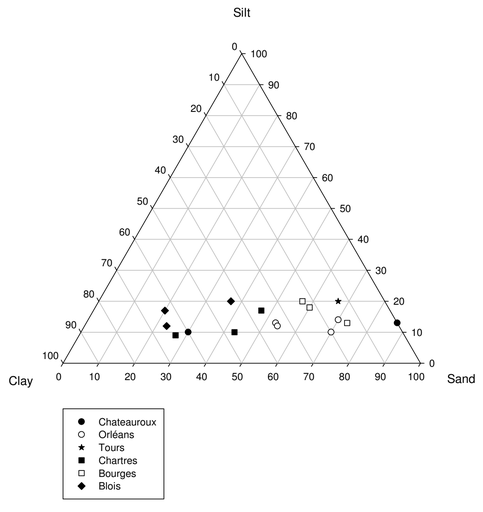



Schematic diagram of a deep well connected to a detection well

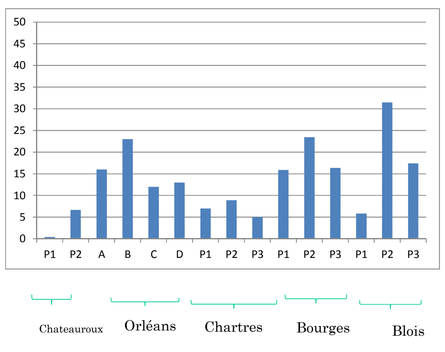
## Results

- Large green area (type 1): Lacustrian Limestone (Oligocene)
  Parc de l'Arrou, Blois
- Neighborhood green area (type 2): Flint clay
  Parc Central, Chartres
- Historical park (type 3): Sand and lacustrian limestone (Eocene)
  Parc Pasteur, Orléans
- Semi-natural area and woodland (type 4): Jurassic Limestone and marls
  Prairie St-Gildas, Châteauroux
  Jardin Lazenay, Bourges
- Family gardens (type 5): Cretaceous sup. chalk and sands
  Jardins familiaux de la Bergeonnerie, Tours

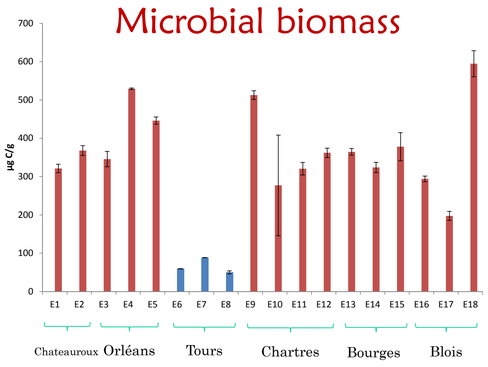
**Surface soils texture**

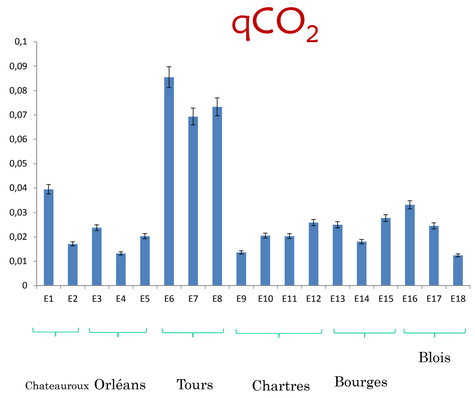


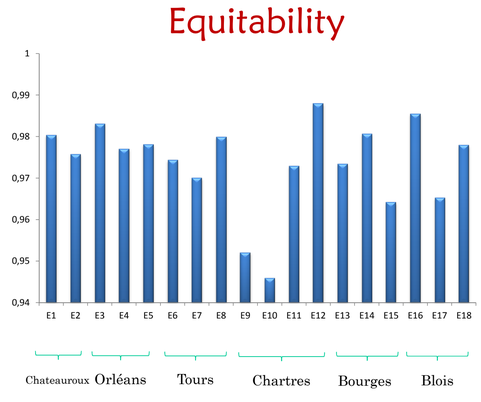

**% of raw material of the surface soils**




**Microbial parameters**




**Physico-chemical characteristics of the surface soils**

| | Chateauroux | Orléans | Tours | Chartres | Bourges | Blois |
|---|---|---|---|---|---|---|
| pH eau | 7,1 | 7,3 | 7,8 | 7,6 | 7,6 | 7,3 |
| Corga g/kg sol | 25,5 | 69,6 | 56,6 | 13,6 | 30,2 | 21,7 |
| N g/kg sol | 5,1 | 4,81 | 3,36 | 3,6 | 6,9 | 5,9 |
| C/N | 5,0 | 14,5 | 16,8 | 3,8 | 4,4 | 3,7 |
| Mg++ ex. (cmol/kg) | 16,97 | | | 8,13 | 8,25 | 8,48 |
| K+ éch. (cmol/kg) | 12,18 | | | 5,17 | 2,76 | 6,08 |
| Ca++ ex. (cmol/kg) | 153,9 | | | 91,03 | 2213 | 153,8 |

## Conclusion

Results from this study showed that except for one site the microbial biomass for all samples was high. Metabolic quotients (qCO2) were in contrast variable for the different parks whether Shannon diversity indexes were quite similar for all the samples. The soil ecosystem has significantly influenced the functions of soil microbial community and hence probably its composition. More generally, catabolic diversity of soil microbial community is variable under the influence of various gardening practices and geological contexts. .